EASTWARD RANGE EXTENSION IN CANADA OF THE ALDERFLY *SIALIS VELATA* (MEGALOPTERA: SIALIDAE), AND THE POTENTIAL OF THE GENUS AS A CONTAMINANT MONITOR[1]

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ABSTRACT: We report on a range extension for *Sialis velata* (Megaloptera: Sialidae) in eastern Canada and assess the potential of the genus as a metal biomonitor.

Sialis velata Ross is reported from the province of Quebec for the first time since its original collections (Ross 1937). Ours is the first record of any *Sialis* species from the province since 1937. All previous collections of the five *Sialis* species known from the province (*S. velata, S. iola, S. itasca, S. mohri* and *S. vagans*) were from the extreme southwestern corner near the city of Montreal (≈ 44°N, 73°W) (Ross 1937; Whiting 1991). It is now possible to extend the range of *S. velata*, north to the 47th parallel, and east to the Quebec City region (71°W). Ours is the most easterly record for *S. velata* in Canada. Only two *Sialis* species are known to occur in Canada east of Quebec City, i.e., *S. mohri* (New Brunswick) and *S. vagans* (New Brunswick and Nova Scotia) (Ross 1937, Whiting 1991). Because we have found *Sialis* larvae in the majority of the Quebec lakes that we have visited, the lack of collection records in eastern Canada is likely a consequence of a lack of effort in collecting adults and rearing larvae rather than the rarity of the genus in eastern Canada.

Adults of *S. velata* (five males, three females) were reared from a large number of larvae collected on May 18 1997, from soft mud at a depth of 5 m in a Shield lake (Lake St-Joseph; 46°55'N, 71°40'W). *Sialis* larvae for rearing were held individually in small plastic containers, in 50 ml of water that was renewed weekly, and fed live chironomid larvae. Gut content analysis indicated that larvae in the field fed largely on chironomids and oligochaetes, as has been reported by previous investigators (Azam and Anderson 1969, Pritchard and Leischner 1973, Canterbury 1978). When individual larvae exhibited agitated swimming behavior at the water surface they were transferred to a small plastic container filled with a mixture of sand and soil for pupation. In the laboratory, pupation and adult emergence were highly successful at room temperature (10% mortality), but not at 10°C (100% mortality). Our results are consistent with those of Elliott (1996), who found that pupation success could be described by a quadratic equation with a threshold at approximately 7°C and an optimum at 15°.

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Our interest in the larvae of *Sialis* relates to their potential as a contaminant biomonitor by virtue of the following properties (with quotations from Phillips and Rainbow 1993):

1. **Widespread and abundant** «Biomonitors should be abundant throughout the study area.» The genus occurs throughout the Holarctic region. In our studies, larvae were collected in 21 of 34 Quebec and Ontario lakes sampled in a cursory manner. This ease of collection suggests that larvae are abundant when present.

2. **Easily kept in the laboratory** «The organism used should be easy to sample and hardy enough to survive under laboratory conditions.» We have captured *Sialis* larvae using both grabs and diver-operated benthic nets. We can keep *Sialis* larvae for periods of up to 3 months at 10°C in the laboratory in water alone (no sediment) with weekly feeding of live chironomid larvae. Given this ease of maintenance in the laboratory, *Sialis* larvae could be used to probe mechanisms of contaminant accumulation and toxicity.

3. **Large size** «The organism should provide sufficient tissue for contaminant analysis. » We have successfully measured several trace metals in whole individual larvae as well as in various larval tissues (pooled samples of several individuals; Hare et al. 1991).

4. **Contaminant tolerant** «Contaminants should be accumulated without lethal impacts to the species employed.» An effective biomonitor should be found along the full range of contaminant concentrations encountered in nature. *Sialis* species are found in lakes influenced by acid mine drainage (e.g., Gatewood and Tarter 1983), or metal smelters (Hare and Tessier, unpublished), both of which tend to be characterized by low pH's (down to pH 4) and high concentrations of trace metals (e.g., up to 14 nM total dissolved Cd). This is a clear indication of metal and hydrogen ion resistance in *Sialis*.

5. **Relation between animal and contaminant concentrations** «A simple correlation should exist between the contaminant content of a biomonitor and the average contaminant concentration in its ambient environment.» Initial analysis of data from 17 lakes suggests that Cd concentrations in *Sialis* are directly related to those of the free metal ion, Cd^{2+}, when the competitive effect of hydrogen ions on biological uptake sites is taken into account (e.g., Hare and Tessier 1996).

Given the above-described characteristics of *Sialis* larvae, their potential as a contaminant biomonitor seems high. However, the effective use of these

larvae as metal biomonitors could be improved by acquiring more information on their: (i) Feeding: we do not know how *Sialis* larvae obtain trace metals, i.e. from the water in contact with their gills, or from the food they eat. This information will help us to determine if food-related variables such as prey type, trophic position and metal assimilation rates (at present largely unknown) should be included in the development of predictive bioaccumulation models; (ii) Burrowing: because *Sialis* larvae are burrowers (Charbonneau et al. 1997), more information on the depth, form and rate of burrowing could be useful in understanding their exposure to sedimentary metals.

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